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# THE JOURNAL OF PHILOSOPHY

## PSYCHOLOGY AND SCIENTIFIC METHODS

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### ERNST MACH AND THE NEW EMPIRICISM<sup>1</sup>

WITH the recent death of Professor Ernst Mach another prominent figure has passed from the field of philosophy. To us in America this event has perhaps an exceptional interest, for Mach was a pioneer in the movement which has resulted during the past two decades in so profound a change in our philosophical outlook and temper of mind. For those who rejoice in this change, Mach's career is that of a prophet preaching a gospel of empiricism to a generation corrupted by the philosophy of transcendentalism and a metaphysics that mistook itself for natural science. Whether we regard Mach as a prophet or simply as a physicist with a mischievous tendency towards speculation, at any rate, the reward of a prophet, in a mild degree, was his. For a long time the attitude towards Mach was the attitude which the world has always adopted towards those who wilfully and maliciously disturb the peace. Among philosophers Mach's status was more or less that of a *parvenu*, lacking in a proper sense of modesty and of reverence for sacred things. In the household of physics, where he had been reared, his views regarding the nature of the concepts underlying physical science were likewise regarded with suspicion. That the relations were somewhat strained appears from Mach's own utterance, as follows: "We can see that the physicists are on the surest road to becoming a church, and are already appropriating all the customary means to this end. To this I simply answer: 'If belief in the reality of atoms is so essential for you, I hereby abandon the physicist's manner of thought, . . . I will be no regular physicist, . . . I will renounce all scientific recognition; in short, the communion of the faithful I will decline with best thanks. For dearer to me is freedom of thought.'"<sup>2</sup>

Apparently Mach himself was somewhat uncertain as to his real status; at all events he repeatedly asserted that he was not a philosopher, although, during the later years of his life, he could not

<sup>1</sup> Read at the meeting of the Western Philosophical Association, St. Louis, April, 1916.

<sup>2</sup> Quoted from the *Monist*, Vol. 21, page 33.

well deny the soft impeachment of being a professor of philosophy. That the distinction is a significant one it would be folly to question, but Mach's reason for the distinction is, let us hope, more dubious than the distinction itself. He disclaims being a philosopher for the reason that philosophy commonly insists upon a distinction between appearance and reality, or between the phenomenal and the transcendental, a distinction to which Mach felt himself unable to subscribe. And since such labors as his were all too easily dismissed as "mere psychology" or else as just scientific methodology, he signifies his willingness to waive the point and once more forego the communion of the faithful by remaining identified with those who seek no reality beyond that which is revealed in the world of everyday experience. In spirit or temper this is the attitude which in this country has called itself radical or immediate empiricism. In Mach's own words: "I must say with Schuppe, 'The land of the transcendental is closed to me.' And if I add the open confession that its inhabitants do not arouse my curiosity at all, it will be possible to measure the gulf that exists between many philosophers and myself. I have therefore already declared expressly that I *am not a philosopher at all, but only a scientist*. If, nevertheless, I have sometimes been numbered with the former, in somewhat loud fashion, I can not hold myself responsible for this."<sup>3</sup>

When used with this invidious connotation the term philosophy comprises all attempts to give a systematic account of human experience in terms of non-experiential reals. To all such attempts Mach felt a constitutional aversion, and so he found himself quite as much out of sympathy with materialism and subjectivism as with transcendentalism. "I make no pretension to the title of philosopher. I only seek to adopt in physics a point of view that need not be changed the moment our glance is carried over into the domain of another science; for ultimately all must form one whole. The molecular physics of to-day certainly does not meet this requirement."<sup>4</sup> Again he says: "There is no conceivable possibility by which the customary elements of present-day physics, viz., masses and motions, taken in all the rigidity which is requisite for these special sciences, could account for any sort of psychical occurrence."<sup>5</sup> But Mach is no less explicit in his rejection of subjectivism.<sup>6</sup> To conceive of sensations as entirely different from physical objects is simply to choose the other alternative of a false dualism. And to

<sup>3</sup> "Erkenntnis und Irrtum," Preface. (The references are to the second German edition.)

<sup>4</sup> "Analysis of the Sensations," English translation by Williams. Page 23, note.

<sup>5</sup> "Erk. u. Irrtum," page 12, note.

<sup>6</sup> Cf. "Erk. u. Irrtum," Chap. I., and "Analysis," Chap. I.

attempt a reconciliation of these two abstractions by means of a thing-in-itself or some other form of "metaphysical deviltry" is to make the confusion worse confounded. All such attempts mean a crossing of the boundary line beyond which "looms but the horror of the shade." "For me," he says, "every scientific labor which does not *hold fast* to the immediately given and which, instead of determining the *relations* of the characters of the given, goes off fishing somewhere in a vacuum, is labor lost."<sup>7</sup>

Such a programme as Mach proposes involves an extensive modification of customary views. If the purpose of scientific inquiry be restricted to the investigation of the relations that obtain among our various experiences, the purpose and value of such inquiry must be simply to enable us to make use of a given experience as a clue to other experiences. Starting with a given experience, the scientific law makes it possible for us to fill in the rest of the picture without being obliged to resort to direct experience in order to find out the meaning or value of what is given. "It is the object of science to replace or *save* experiences by the reproduction and anticipation of facts in thought."<sup>8</sup> "In nature there is no *law* of refraction, only different cases of refraction. The law of refraction is a concise, compendious rule, devised by us for the mental reconstruction of a fact, and only for its reconstruction in part, that is, on its geometrical side."<sup>9</sup> "There is every reason for distinguishing sharply between our theoretical conceptions of phenomena and that which we observe. The former must be regarded as merely auxiliary instruments which have been created for a *definite* purpose and which possess permanent value only with respect to that purpose." They "must be regarded as mere helps or expedients to facilitate our consideration of things."<sup>10</sup>

The same interpretation, we find, applies to the concepts of the physical and psychical, which have played so ominous a rôle in the history of thought. Mach warns us that in the study of the physical and psychical "we must not allow ourselves to be impeded by such intellectual abridgments and delimitations as body, ego, matter, mind, etc., which have been formed for special, practical purposes and with wholly provisional and limited ends in view."<sup>11</sup> The physical and the psychical, in short, are just names for certain types of relationship between the given and other facts. The immediately given consists of certain elements, such as colors, sounds, tastes, and smells. These elements are not produced by material

<sup>7</sup> "Erk. u. Irrtum," page 13, note.

<sup>8</sup> "Science of Mechanics," Eng. transl. by McCormack, page 481.

<sup>9</sup> *Ibid.*, pages 485, 486.

<sup>10</sup> "Analysis," pages 186, 187.

<sup>11</sup> *Ibid.*, pages 23, 24.

objects; they make up material objects. When we investigate a given experience, we find that it consists of elements variously related or conditioned. There are no isolated or detached elements. In so far as this conditioning takes place outside the body, these elements are physical; in so far as the elements are conditioned by the body of the observer, they are mental or psychic. "A color is a physical object so long as we consider its dependence upon its luminous source, upon other colors, upon heat, upon space, and so forth. Regarding, however, its dependence upon the retina, it becomes a psychological object, a sensation. Not the subject, but the direction of our investigation, is different in the two domains."<sup>12</sup>

So far Mach's point of view is commendably clear and definite. The element or sensation is the final reality. The element itself, Mach argues, "we should not try to explain. It is something so simple and fundamental that its reduction to something more simple can not succeed, at least for the present. The single sensation is neither conscious nor unconscious. It becomes conscious through interrelation with the occurrences of the present."<sup>13</sup> The interrelation by virtue of which the sensation becomes conscious is, of course, the relation to the body, as indicated a moment ago. It is when we inquire further into the relations of the elements that the fog begins to settle down and both the element and its relations are lost to sight.

As may be anticipated, the clearness of Mach's doctrine springs from an oversimplification of the facts. The relations maintained by a given element to the body and to other elements outside the body are more complicated and confusing than appears at first sight. To consider first the extra-bodily relations of the element, a study of these relations soon reveals the fact that the quality with which we start is not an element at all, but a compound. As Mach himself points out, primitive man, like the lower animals, "probably takes the objects of the environment as wholes, the contributions which are made by the different senses, but which are given to him only in conjunction, not being separated out."<sup>14</sup> Form and color are not distinguished, and still less is a blending of colors reduced to its elements. The analysis of experience into elements is a progressive affair; the analysis, for example, of noises into simple tones is an achievement of modern science; and, in general, it can scarcely be denied that the possibilities of analysis extend beyond any definitely assignable limit. Our elements, therefore, turn out to be, as Mach himself recognizes, merely provisional elements, and the hy-

<sup>12</sup> *Ibid.*, pages 14, 15.

<sup>13</sup> "Erk. u. Irrtum," page 44.

<sup>14</sup> *Ibid.*, page 12, note.

pothesis that there are final and irreducible elements becomes—at least for an avowed empiricist—a gratuitous assumption.

This result, perhaps, constitutes no great cause for alarm. If, however, we now turn to the relation of the given to the perceiving organism, the situation becomes more serious. The visual object, we find, is related not only to the retina, but to the various neural processes induced by the optical stimulus. All this is clear enough, but Mach is aware that it is not sufficient, after all, to trace out the bodily facts or conditions to which the experiential object is related in the conscious situation. It is also necessary to ascertain what sort of a change it is that takes place when consciousness arises. Is it sufficient to say that the mere addition of a neural process to something else is the change which constitutes the consciousness or awareness of what is given? In some connections Mach seems to hold this view. "Consciousness," as he says on one occasion, "is precisely a specific, important interrelationship of the parts of the brain."<sup>15</sup> But this is plain materialism and does not represent Mach's more habitual point of view. The transition to another standpoint is accomplished by the substitution of certain other elements for the neural process in question. These elements are not identical with the neural process, but stand to this process in a relation of independence. Consciousness is just a certain organization of elements, and the elements which must add themselves to what is already present are those which depend upon the processes of memory and association. When a nervous system has once undergone certain modifications, subsequent stimulations normally arouse or revive certain copies or images of the previous occurrence. These images are likewise elements, differing only in degree from those of a sensory kind. They blend with the sensory contents or elements and provide them with a context; and it is only when this happens that consciousness is present. "Consciousness is no specific (psychic) quality or class of qualities, which distinguishes itself from physical qualities; neither is it a specific quality that must add itself to the physical in order to transform the unconscious into the conscious. Both introspection and the observation of living beings to which we are obliged to ascribe consciousness analogous to our own, teach us that the height of consciousness varies with the richness, the ease, rapidity, vivacity, and orderliness of these functions. Consciousness does not consist in a specific quality, but in a *specific connection* of given qualities."<sup>16</sup>

The import of this doctrine is that when we approach the given from the side of the body, the "element" once more eludes our grasp. The given which is related to the body is not an element,

<sup>15</sup> *Ibid.*, page 109.

<sup>16</sup> *Ibid.*, pages 43, 44.

but represents a blending of a sensory content with various images or revived impressions. "The city hall which I pass," says Mach, "would be for me merely a spatial arrangement of colored spots, if I had not already seen many buildings, walked through their passages, and mounted their stairs. Recollections of manifold impressions become interwoven with the optical sensation so as to constitute a much more richly endowed complex, the observation, from which we separate the merely momentary sensation only with difficulty."<sup>17</sup> If, however, our perceptions of ordinary sense-qualities are inevitably interwoven with revived impressions, and if these revived impressions, in turn, are the outcome of previous blendings, the attempt to analyze out ultimate constituents or elements is suspiciously like the quest for the pot of gold at the foot of the rainbow. We escape materialism only to fall into the pit of "mental chemistry." These constituents never enter human experience at all, and an explanation of experience in terms of them is, in principle, the same sort of thing as an explanation in terms of masses and motions or of transcendental realities. In other words, Mach himself commits the unpardonable methodological sin—a result which indicates that correct empirical procedure requires considerably more than a pious resolution to have no dealings with unknowables.

Does this result warrant the inference that the empirical method has failed? By no means. There is good ground for the view that the undertaking has miscarried just because the empirical method was not maintained throughout. In the interpretation of concepts and laws Mach takes his clue from adaptation and so remains on the empirical level; but in the interpretation of sensory experience he abandons this method and explains such experience and the changes effected in it as a result of the process of analysis by taking appeal to certain groupings or blendings of non-empirical "elements." This is plainly a failure to "hold fast to the immediately given" and a surrender to the temptation to find solutions for our problems in the "airy nothings" of words.

The point that I wish to emphasize is that the spirit of Mach's own method requires an interpretation of the changes wrought by analysis in terms of specific and ascertainable conditions, and not in terms of inaccessible "elements." The suggestion lies at hand that, since concepts are to be regarded as "mere helps or expedients to facilitate our consideration of things," so the analysis of an object into various qualities or attributes may be just a device for the facilitation of our adaptation to it. Or, more generally, the nature of consciousness is to be sought, not in an inscrutable organization of elements or qualities, but in a certain transformation of objects in

<sup>17</sup> *Ibid.*, page 21. Cf. also page 36.

the interests of adaptive behavior. As Mach points out, in ordinary reflexes stimulus and response are immediately associated; and consciousness supervenes only when the mechanical stimulus has become inadequate. "When the simple stimulus, owing to complication of the conditions of life, becomes too ambiguous to determine behavior of an adaptive kind, the sensation appears as an independent element, which, together with recollections and images, determines the condition of the organism, the affective mood, and thus finally sets free activity having a conscious end."<sup>18</sup> The "ambiguity" of the stimulus means that a variety of conflicting responses are brought into play, so that a deadlock ensues, which can be ended only by the advent of a new stimulus. If we read off the hypothetical fusion of recollections and images with the sensory content as a transformation of the stimulus, the way is open for a consistent application of empirical method all along the line.

The importance of this topic for empirical method must be my apology for venturing upon a brief excursion in this direction. As Mach intimates, the effect of past experiences is to provide the present situation with a conscious end or goal. The result that is still to be attained somehow comes in to give direction to present conduct. The problem of consciousness, then, is the problem of explaining how a future result or consequence can operate so as to determine present conduct. Concerning the fact itself there is scarcely room for dispute. A plant, for example, will respond to rain, *after* the rain has come, by putting forth new shoots and leaves; but an intelligent being will respond to the rain *before* the rain has arrived, by seeking shelter or by hurriedly sowing grass seed on the barren patches of the lawn. The rain which is still to come, which is not yet a present fact at all, gives direction to conduct. But how is this possible? How can a non-existent future control the affairs of the present? It is plain that the future must somehow get into the present in order to become effective for conduct; and this transfer of the future into the present is precisely what is meant by consciousness.

At first sight this anticipation of the future is likely to have an appearance of mystery similar to that of prophecy. The facts of bodily behavior, however, indicate that this anticipation has a physical basis. That the human nervous system has an extraordinary capacity for receiving and retaining modifications is a familiar fact. If a person has once been burned by a fire, the response that is set up by the optical stimulation originating from fire is likely to be different ever after. The body will tend to repeat the movements of withdrawal that were originally caused by the burn, *i. e.*, the body

<sup>18</sup> *Ibid.*, pages 108, 109.

engages in defensive movements before the burn occurs. Speaking metaphorically, the bodily movements anticipate a stimulus, viz., a burn, which has not yet arrived. Similarly, if a hungry person sees a tempting morsel, his mouth waters and his jaw tends to move at the same time that his hand goes out towards the food. These acts originally occurred in succession, but now they are set off simultaneously. The nervous system has acquired a certain set or mode of behavior, so that the entire little episode is acted out beforehand in a miniature way. The object is being grasped and eaten before it is even touched. Here again the bodily movements "anticipate" stimuli that still lie in the future.

These facts acquire significance for the theory of consciousness if we relate them to the view that consciousness arises in response to a biological need. As long as our responses work smoothly, behavior remains on the plane of reflex activity. But let a physical stimulus evoke a number of incompatible responses—or, in Mach's phrase, let a stimulus become ambiguous—and a crisis sets in. The responses oppose or collide with one another, and instead of adaptive behavior, the result is a state of tension or inhibition; and the only way to secure adaptive behavior is to secure a stimulus that is able to effect such an organization of these conflicting activities as will further the interests or needs of the organism.

To acquire such a stimulus and to be conscious are one and the same thing. The conscious stimulus is of a unique kind, and this unique character is determined by the responses which are still inhibited and struggling for expression. More specifically, the character of this new stimulus is determined by the adaptive value of the nascent activities. The incipient response to "burn" or "hot," for example, is a response which, if it were to attain full-blown completion, would be a maladaptation. This nascent response is the echo of a response which came as a convulsive shock and which disorganized the vital processes of the body. On the other hand, the response to food is a response which, if carried out, would have adaptive value, since it expresses the biological need of nutrition. These suppressed responses would be good or bad, *if they were completed*; and the change that is wrought in the stimulus is a change that makes it a stimulus for the realization of the adaptive values which are thus foreshadowed or anticipated. To say that the fire looks hot is to say that the fire is a stimulus which controls the organism so as to avoid the maladaptation of being burned; to see an object as "good to eat" is to have a stimulus that promotes the interests of the organism by inducing the activities appropriate to eating. The distinctive character of the conscious stimulus is this control by future consequences; and consciousness, accordingly, is just a name for the control of behavior by future consequences or results.

It is hardly necessary, perhaps, to add that these stimuli are subject to development concomitantly with the development of the nervous system. The range of variation is all the way from a stimulus presented in early infancy and describable only as "exciting" to the highly differentiated and complicated environment of the civilized adult. From this standpoint the differentiation or the analysis of objects or qualities necessarily has reference throughout to behavior. Adaptation is the standard, not only in the interpretation of concepts, to which this standard was applied by Mach, but in the interpretation of every form of experience. Unless the interpretation be made thoroughgoing, the concept and the given fall apart; meanings do not grow out of experience, but become mere guesswork, random and arbitrary attempts at reconstruction, without a proper criterion or motivation. The elaboration of this interpretation does not come within the scope of the present discussion. Whatever its merits, it may serve to point out, in a general way, the implications of the empirical method for which Mach stood sponsor. As was suggested previously, it was precisely in connection with the problem of consciousness (or of analysis) that Mach's instinct for the concrete deserted him and permitted him to take refuge in the doctrine of irreducible elements. Hence the peculiarity of consciousness as behavior determined by future results escapes his notice and leaves him wavering between materialism and atomistic subjectivism. Neither of these alternatives is capable of treating human conduct as other than a complicated form of mechanism,<sup>19</sup> or of bringing its explanation of experience out of the darkness of metaphysical abstraction into the light of common day.

As judged by the requirements of empirical method, Mach's work undeniably has many shortcomings. Yet the success or failure of this method in his hands is, in a sense, a matter of minor importance. Of far greater moment is the spirit or attitude which he helped to create. If we measure Mach's achievement, as is proper, by what he did to make clear the task or function of philosophy, his work entitles him to a permanent place in the record of human progress. For Mach the empirical method meant ultimately that philosophy must justify itself, not as an intellectual pastime or as an emotional indulgence, nor yet as an escape from the unwelcome realities of our present existence, but by its bearing on human weal and woe. All knowledge is, for Mach, "a psychical occurrence which either immediately, or at any rate mediately, promotes biological adaptation."<sup>20</sup> Fundamentally the appeal to concrete experience is an insistence that philosophy is under obligation to furnish an insight into the relation of the individual to his world which will

<sup>19</sup> Cf. "Erk. u. Irrtum," chapter on "Reflex, Instinct, Will, Ego."

<sup>20</sup> *Ibid.*, page 115.

be of service in the attainment of specific ends and values. A philosophy that ignores the needs and demands for better adaptation of our human life, here and now, forfeits its claim to consideration. On the other hand, the hope of better adaptation furnishes a constant incentive and inspiration. This *motif* stands out in the closing sentences of "*Erkenntnis und Irrtum*," where Mach says: "If we reflect on the agonies that our ancestors had to endure under the brutality of their social institutions, their legal systems and courts of justice, their superstitions and their fanaticisms, if we consider the rich heritage of the present in these goods, if we imagine what we shall possess of these goods in our descendants, we find in all this a sufficiently powerful incentive to cooperate, zealously and vigorously, with the help of our psychological and sociological insight, for the realization of an ideal moral world-order. And when we have once created such a moral order, no one will then be able to say that it does *not* exist in the world, and no one will have the need to seek for it in mystical heights or depths."

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## TWO RATIONAL MORALISTS

TWO American scholars, from two different points of view, have lately revived the old doctrine that virtue is knowledge. What a change of tone from the pragmatism and instinct-worship of these recent years! It would be interesting if the present war should mark the end of that romantic infatuation which for a century has been glorifying will, work, struggle, contradiction, and instability, without any idea or hope of an ultimate good. At a moment when the dreadful corollaries of this heathenism have turned the earth more than ever into a hell, it would be some compensation to recover the true though unrealizable ideals of the race, and again to believe in harmony, in intelligence, in perfection, and perhaps even in heaven.

Professor John Erskine has collected four addresses under the title, "The Moral Obligation to be Intelligent."<sup>1</sup> In them he represents intelligence as both the means and the end of true progress. Affection, he says in effect, is partiality, it is a sort of animal loyalty, while intelligence is the same as universal sympathy. It unites men separated by material interests and passions; it is the one stimulus to justice. It is also the ultimate good to which our nature is addressed. We hear a great deal of the duty of service, but service should not consist in degrading the lives of the best men by subordinating them to the aims of vulgar natures. Rather, by force of example and con-

<sup>1</sup> New York. Duffield & Co. 1915.